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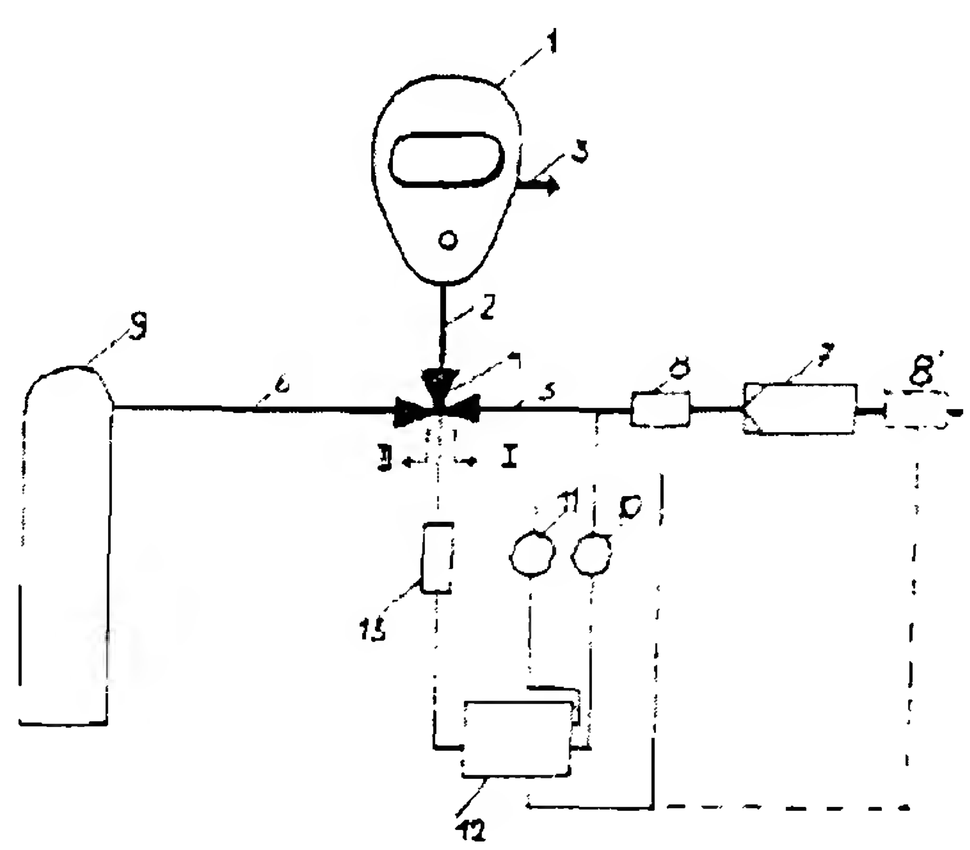
An examination request under § 44 PatG has been filed.

(54) Breathing protection mask

(57) A breathing protection mask (1) can be switched so that a breathing connection to a compressed-air cylinder (9) is diverted to a connection of a filter (4) in communication with the surrounding atmosphere, which filter is equipped with a closed-loop control system (12) that uses a control element (13) to actuate a changeover valve (4) when a threshold value is reached, as determined by means of at least one sensor (10, 11) of a gas metering device. The "on" status at a given time is indicated to the wearer of the mask (1); likewise, the fill level of the compressed-air cylinder (9), the condition of the filter (7) and the charge state of the batteries used in the closed-loop control system can be indicated in easily recognizable form.
For safety reasons, in an emergency, the changeover valve (4) can be uncoupled from the control element (13) and the changeover done by hand.



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The following information is from documents filed by the applicant.

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Description

In a breathing protection mask equipped with a filter, it is known (DE-U-94 07 866) to detect by means of a gas metering device undesirable increases in the concentration of noxious gas between the filter and the mask and to indicate them visibly on the mask for the wearer. The prior art also includes safety helmets (EP-A-0325959) which, to supply breathable air in an unhealthy environment, are connected to a compressed-air cylinder and can be switched back and forth from compressed air to surrounding air, as needed, by means of a hand-operated changeover valve. Nor is it novel (DE-C-42 07 533) to use signals from a gas metering device cooperating with a closed-loop control system to actuate such a changeover valve on a breathing protection mask. In the last-cited prior art, however, there is no option of changing over to a compressed-air cylinder, as is necessary when the wearer has to spend time in a highly toxic environment. The object underlying the invention is to fill this gap, the design of the sensor system being an essential factor in the durability and safety of the apparatus.

This object is achieved by means of the features recited in Claim 1. A second solution to the same problem lies in the features recited in Claim 4.

The advantages achieved by means of the invention are, in particular, that a wearer using the mask in a fire or other disaster situation can concentrate on his duty without being distracted, and the necessary compressed air consumption can simultaneously be kept to a minimum.

Claims 2 and 3 contain advantageous configurations of the invention according to Claim 1, while Claims 5 and 6 similarly put forward advantageous configurations based upon Claim 4. It is further advantageous if, as set forth in Claim 7, the wearer of the gas mask can see within his field of view, for example by means of light-emitting diodes, the "on" status at a given time, the fill level of the compressed-air cylinder, the permeability of the filter and the charge state of the particular batteries. For increased safety, according to Claim 8 the changeover valve is to be equipped with a handle that is readily accessible to the wearer of the breathing protection mask, but is secured by a lock against accidental movement, and which, when the lock is released, decouples the control element from the changeover valve and permits movement by hand to effect the changeover.

Exemplary embodiments of the invention are depicted in the drawing and will be described in more detail hereinafter.

In the drawing:

Fig. 1 is a circuit diagram of a device according to the invention, operating with an external and an internal sensor,

Fig. 2 is the elementary circuit diagram of a changeover valve with a translationally moved control piston,

Fig. 3 is the elementary circuit diagram of a changeover valve with a rotary slide,

Fig. 4 is a circuit diagram of a device according to the invention that operates with an internal sensor and continuous pumping action,

Fig. 5 is the elementary circuit diagram of a changeover valve with a translationally moved control piston that combines the actions of switching back and forth between two different connections,

Fig. 6 is the elementary circuit diagram of a rotary slide that combines the actions of switching back and forth between two different connections.

Figure 1 shows the mask 1 with a connection 2 to the changeover valve 4. The used respiratory air escapes from the mask 1 into the environment through a known valve 3. From the changeover valve 4, a connection 5 leads via a fan or other intake device 8 to the filter 7 and on into the surrounding atmosphere. The boosting of the stream of air fed through the filter 7 can also be effected by means of a compressed-air feeder 8'.

Located in the connecting space behind the filter 7 in the direction of flow is sensor 10, which relays the pollutant concentration to a gas metering device in the closed-loop controller 12, which device simultaneously receives and is able to store the pollution level of the outside air from sensor 11 for purposes of comparison, so that the difference can be used as a basis for subsequent decision-making with regard to a threshold value for changing back to filter mode from compressed-air mode, when only the external sensor is on. When a threshold value is reached, a control signal passes from the closed-loop controller 12 to the control element 13, which, in any

given manner known to those skilled in the art, converts the control pulse into a translational or a rotary movement of the particular control slide used in the changeover valve 4. Line 6 connects the changeover valve to the compressed-air cylinder 9.

Figures 2 and 3 illustrate possible exemplary embodiments of control slides in principle. In the form depicted in Fig. 2, the connection from the wearer of the breathing protection mask is shown to pass via line 2 to the filter 7 through line 5. When the piston moves to the left, then the right-hand portion of the piston covers line 5 with control edge 23 as it slides over, while control edge 22 opens up line 6 to the compressed-air cylinder.

Figure 3 also indicates the open connection of the breathing protection mask 1 via line 2 to the filter 7 via line 5. A clockwise rotation of cylinder 25 would, via bore 26, open up the connection to line 6 and thus to the compressed-air cylinder 9, while the other end of bore 26 remains in communication with line 2.

In Fig. 4, reference numeral 80 denotes an intake device that is the same in principle as that previously described, but differs from it by being continuously operating. Continuous operation makes it necessary for the air sucked through the filter 70 to be provided with an outlet path when a changeover from the filter 70 to compressed air takes place at changeover valve 40. An additional changeover valve 110 is therefore coupled to the switching movement of changeover valve 40. The outlet path is denoted by 111. The threshold path[1] for the changeover is determined here only by the measurement results from the internal sensor 100. Either of the two solutions cited can have different relevance under different load conditions. In cases where constituents of the ambient air would cause the filter to become clogged more rapidly, the first solution should be given preference. Conversely, the controller 120 is easier to design if the second sensor is omitted. The mode of operation of the changeover valve combination 40, 110 will be described with reference to Figs. 5 and 6.

[1] Translator's Note: Presumably a typographical error for "threshold value" (*Schwellenweg* for *Schwellenwert*).

In the position of the control piston 201 that is illustrated in Fig. 5, the connection of the mask is established via line 20, and line 51 to line 50 and thus to the filter 70 (see Fig. 4). The connection 111 to the atmosphere is closed.

When the control piston moves to the left, connection to line 60 and thus to the compressed-air cylinder 90 is established via line 20. Air sucked in from the filter 70 by the fan 80 flows (past the measurement point for sensor 100) through line 50 to open line 111 into the atmosphere.

In Fig. 6, section I-I through control slide 250 shows the connection of the mask through line 20 via bore 240 to line 51, which is connected by means of the transverse link (shown in broken lines) with parallel section II-II to the continuation there of line 51, via bore 241 to line 50 and thus to the filter 70. As a result of clockwise rotation, line 20, in the sectional diagram on the left, is connected via bore 240 to line 60, thus placing the mask in communication with the compressed-air cylinder. In this process, line 51 is closed and connection 50-111 is opened via bore 241.

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Claims

1. A breathing protection mask comprising a gas metering device having at least one sensor and provided to control a changeover operation in a closed control loop, which sensor is disposed downstream, in the direction of flow, from a filter that is in communication with the surrounding atmosphere, and within which closed control loop the measurement signals can, when a threshold value is reached, be fed as control pulses, via a closed-loop controller, to a control element by means of which a changeover valve having two possible switch positions can be actuated, **characterized in that** a second sensor (11) is provided that registers the concentration of the surrounding atmosphere and whose measurement signals can be set in relation to those of the first said sensor (10) in a comparison program in the closed-loop controller (12), and in that said changeover valve (4), in one of said switch positions (I), places said mask (1) and said filter (7) in communication, and in the other said switch position (II) places said mask (1) in communication with a carried-along compressed-air receptacle (9) known for use as an alternative supply of breathable air, wherein said closed-loop controller (12) supplies, simultaneously with a changeover pulse to said control element (13), a turn-on or turn-off pulse to a fan, a pumping device or the like (8, 8'), which is known per se and is associated with said filter (7), and on the changeover to compressed air, the control variable can be determined from relativized measurements of the surrounding atmosphere from said second sensor (11).

2. The breathing protection mask as in claim 1, characterized in that said changeover valve (4) comprises a control slide (20) having a translationally moved piston (21) with two parallel control edges (22, 23).

3. The breathing protection mask as in claim 1, characterized in that said changeover valve (4) comprises a control slide (24) having a rotatable cylindrical part (25) and a bore (26) which is perpendicular to the axis of rotation and passes therethrough, and which can be connected to the surrounding valve body by means of the appurtenant connection lines (2-5, 2-6).

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4. A breathing protection mask comprising a gas metering device having a sensor and provided to control a changeover operation in a closed control loop, which sensor is disposed downstream, in the direction of flow, from a filter that is in communication with the surrounding atmosphere, and within which closed control loop the measurement signals can, when a threshold value is reached, be fed as control pulses, via a closed-loop controller, to a control element by means of which a changeover valve having two possible switch positions can be actuated, characterized in that for said sensor (100), a fan, a pumping device or the like (80, 80'), which is known per se and is associated with said filter (70), is turned on in both switch positions (I, II) of said changeover valve (40), and a second changeover valve (110) is provided which is coupled to said first changeover valve (40) and which, in the switch position (I) of said changeover valve (40) wherein the latter places said mask (10) and said filter (70) in communication, closes an outflow line (111) to the atmosphere, and in that in the switch position (II) wherein said changeover valve (40) places said mask (10) in communication with a carried-along compressed-air receptacle (90) known for use as an alternative supply of breathable air, said changeover valve (110) opens said outflow line (111) to the atmosphere.

5. The breathing protection mask as in claim 4, characterized in that said first changeover valve (40) and said second changeover valve (110) are combined into a single control slide (200) comprising a translationally moved piston (201) having four parallel circular control edges (202-205).

6. A breathing protection mask as in claim 4, characterized in that said first changeover valve (40) and said second changeover valve (110) are combined into a single control slide (250) having a rotatable cylindrical part (230), wherein in a plane passing through the axis of rotation of said cylindrical part (230), two adjacent parallel bores (240, 241) pass through perpendicular to said axis of rotation and can be connected to corresponding connection lines (20-51, 20-60, and 50-51, 50-111) provided on the surrounding valve body.

7. The breathing protection mask as in claims 1-6, characterized in that readily perceptible to the wearer of said breathing protection mask (1, 10), within his field of view but not obstructing his vision, e.g. light-emitting diodes for indicating the "on" status at a given time, the fill level of said compressed-air cylinder (9, 90), the permeability of said filter (7, 70), e.g. by indicating the pressure drop, and the charge state of the batteries [syntax of claim sic].

8. The breathing protection mask as in claims 1-7, characterized in that provided on said changeover valve (4, 40) is a handle that is readily accessible to the wearer of said breathing protection mask (1, 10), but is secured by a lock against accidental movement, and which, when the lock is released, decouples said control element (13, 130) from said changeover valve (4, 40) and permits movement by hand for the changeover.

Accompanied by 2 page(s) of drawings

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DRAWINGS PAGE 1

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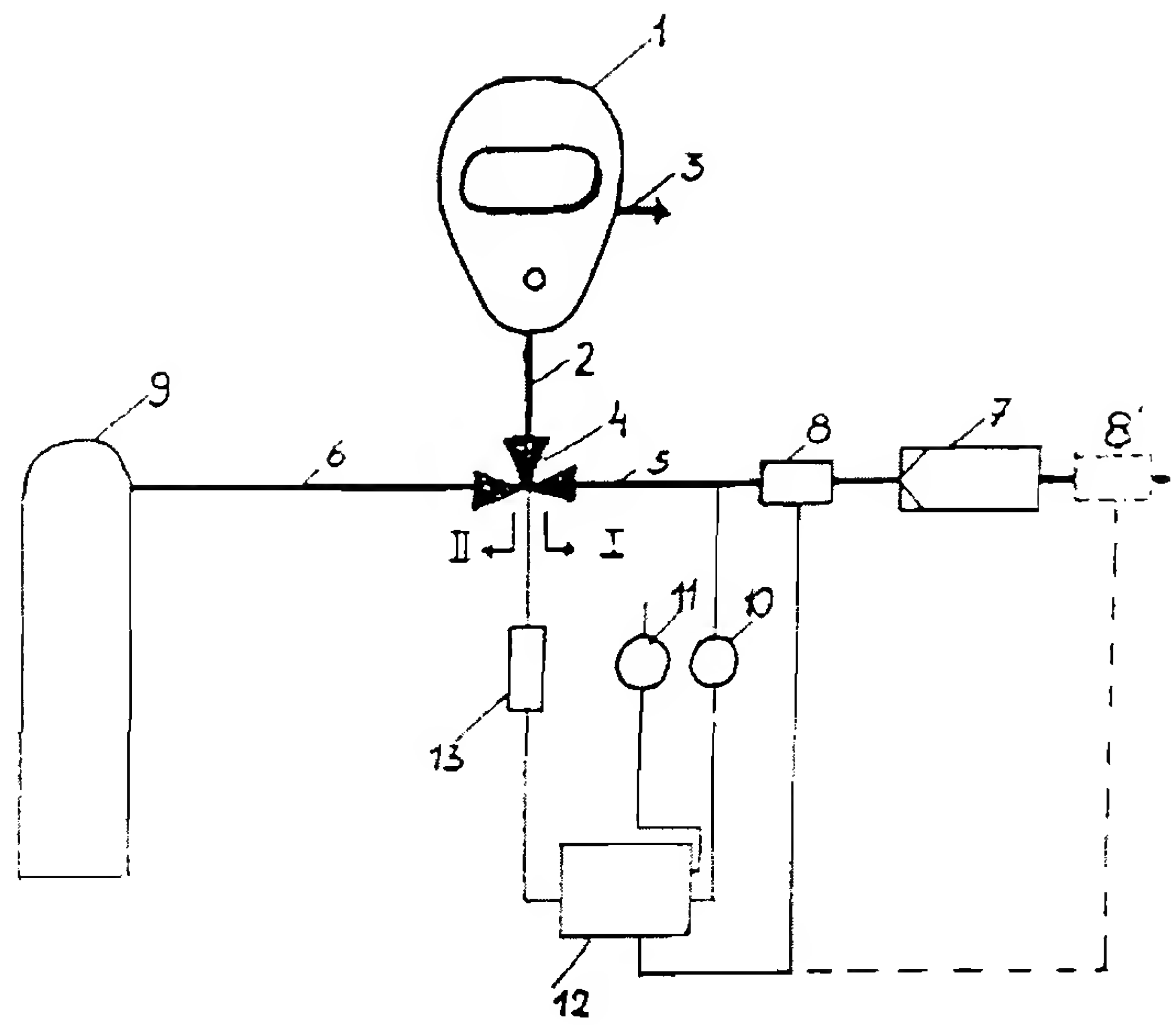

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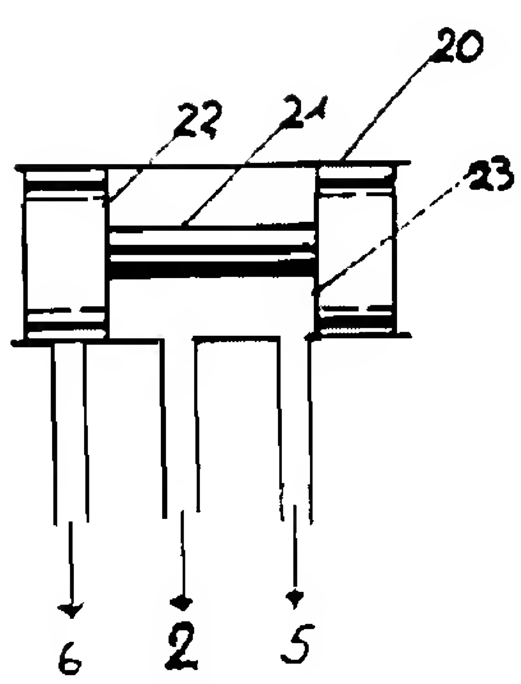

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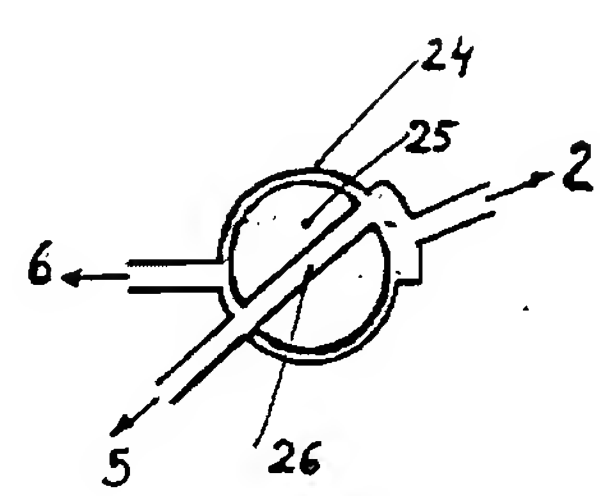

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DRAWINGS PAGE 2

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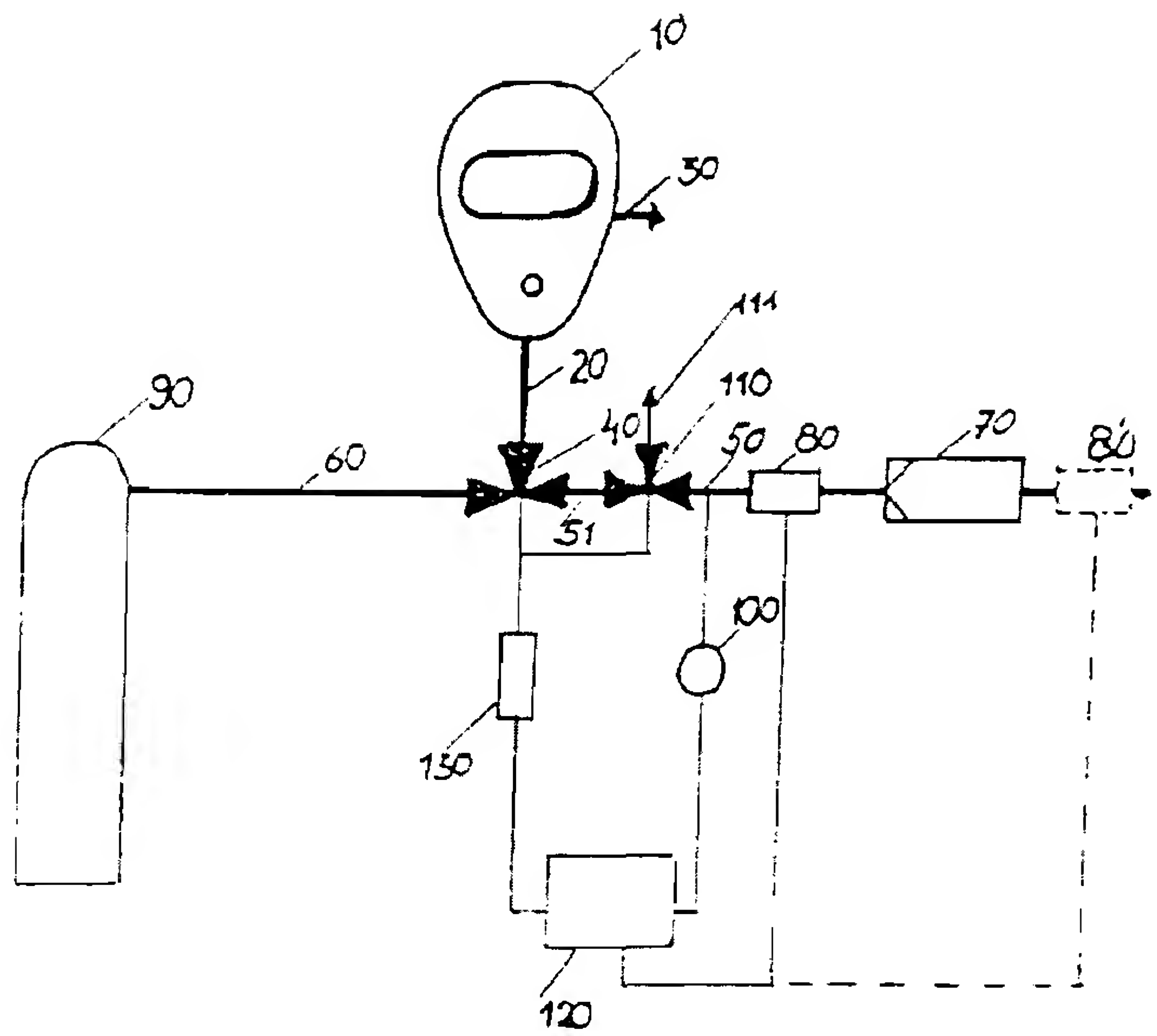

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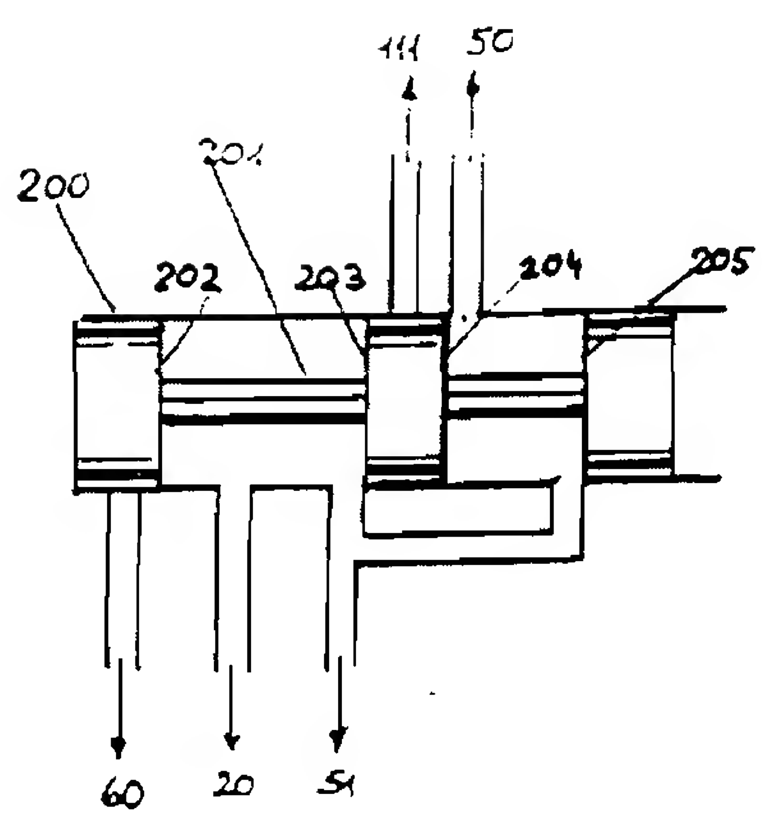

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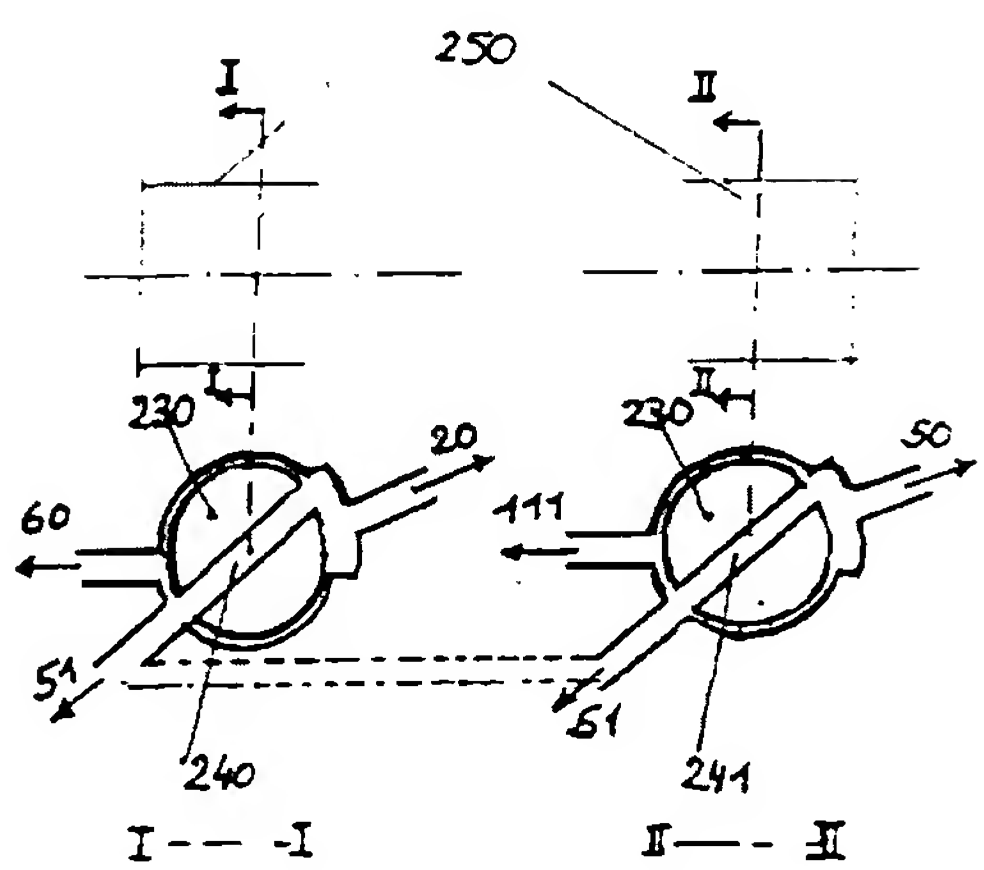

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